

LBNL Safety Review Committee

**Triennial Review of the
Management of Environment, Safety, and Health (MESH)**

ENGINEERING DIVISION

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TRIENNIAL REVIEW OF THE ENGINEERING DIVISION MANAGEMENT OF ENVIRONMENT, SAFETY, AND HEALTH (MESH)

Executive Summary

The Engineering Division has historically a strong ES&H program. The Division's ES&H programs and systems, such as their self-assessment program, accident investigation, and ES&H training, are model programs for the Laboratory. The Division senior management traditionally has taken an active and leadership role in ES&H. The MESH appraisal validates that these activities continue to show success and sustainability. However, there are also opportunities to improve the Division's already excellent programs. The MESH team identified three major areas that the Division should consider for improvement:

(1) **Matrixed Employees.** The Engineering Division has a large number of employees and operating units matrixed to other divisions. The role and responsibility of safety by the Division for its matrixed employees are poorly defined by management and not conveyed clearly to the employees. Safety roles and lines of communication by various combinations of matrixed employees/supervisors and host employees/supervisors are not well understood or documented. Moreover, there is limited oversight by the Engineering Safety Management group to assure that safety of its matrixed employees are adequately addressed. This problem is due in large part to the lack of formal policy and guidance by the Laboratory (i.e., the institution).

(2) **Hazard Reviews.** Hazard reviews, in particular design and fabrication projects and lower hazard activities, are not done consistently throughout the Division. Engineering's policy is that the line managers have the responsibility to review the hazards of their projects. However, there is minimal oversight to ensure that such reviews and follow-up actions occur for all projects. The Project/Facility Safety Review Questionnaire, which is intended to document such reviews, is not widely used.

(3) **Activity Hazard Documents.** Reviews of Activity Hazard Documents (AHDs) are informal or incomplete. The scope and rigor of the AHD reviews are inadequate for projects, such as the Photo Fabrication Shop and the Ultra High Vacuum Facility, that are identified as highly hazardous operations.

A. MESH Appraisal Objective

The purpose of the MESH appraisal is to evaluate the effectiveness of Integrated Safety Management (ISM) in the Engineering Division. The MESH team accomplishes this by 1) reviewing data and documents pertaining to the Division's environment, safety and health program, 2) interviewing key Engineering managers and staff on their ES&H roles and responsibilities, and 3) visiting several Engineering facilities to assess the level of ES&H in the field. Noteworthy practices, observations and findings are identified by the team and presented

in a MESH report to the Berkeley Lab's Safety Review Committee (SRC). The Engineering Division is expected to appear before the SRC and present a plan of action to address all MESH findings.

B. Division Description

The mission of the Engineering Division is to provide engineering and technical resources to contribute to the scientific and technical achievements of the Berkeley Lab's research and development program. The Division has approximately 521 full-time employees. A significant portion of the Engineering employees is matrixed to other Lab divisions in the General Sciences, Biological Sciences, and Energy Sciences. There are eight Engineering departments that provide the site-wide engineering and technical resources. They include Electronics Engineering, Mechanical Engineering, Engineering Sciences, Software Engineering, Systems Engineering, Applied Technologies, Industrial and Energy Partnerships, and Design and Fabrication. In addition to the site-wide resources, the Division provides project management resources for major, long-term research programs such as the Spallation Neutron Source (SNS), Dual Axis Radiographic Hydro Test (DARHT), Advanced Light Source (ALS), and Heavy Ion Fusion (HIF). Engineering personnel work throughout the Laboratory. However, the primary facilities where the Division has overall space responsibility include buildings 25/25A, 46/46A, 77/77A, 7C, 40, 44, 50A, 50B, 62, 70A and 80.

The most common hazards confronting Engineering personnel typically include hazardous chemicals, waste generation, waste treatment, cutting and fabrication of equipment, high temperature ovens and furnaces, high voltages, x-ray machines, and sealed sources. The Division lists eight Activity Hazard Documents (AHDs), primarily involving work with hazardous chemicals and laser equipment. Engineering also has six Sealed Source Authorizations, four wastewater discharge permits, three Waste Accumulation Areas (WAAs), and Satellite Accumulation Areas (SAAs) in the 25, 70A, and 77 building complexes.

The Division's ES&H program is part of the Engineering Operations Group that includes Human Resources, Finance, Sponsored Research, and Space and Property. The Division Safety Coordinator reports directly to the Division Director. The Safety Coordinator, with the support of a deputy and EH&S Division Liaison, assumes the day-to-day operations of the ES&H program. The Coordinator's primary responsibilities include supporting the Safety Committee; leading the Supervisor's Accident Analysis Report (SAAR) investigation; managing the various self-assessment teams that conduct the inspections of Engineering space; and communicating ES&H information and requirements to Division personnel.

The Safety Committee has representatives from each Engineering department and meets quarterly. The Division Director chairs the Safety Committee meetings.

The Division has developed a revamped accident investigation process (i.e., SAAR investigations) to address increased injuries and accidents that occurred several years ago. The revised investigation streamlines the process and utilizes a SAAR investigation team to evaluate root causes and to identify corrective measures to prevent recurrences. Accidents and injuries

have been significantly reduced, and the investigation process is now being used as a model for other divisions.

ES&H self-assessments are performed by Engineering teams who have expertise and/or training in one or more of the following ES&H areas: health and chemical hazards, guarding and lifting equipment, work environment, documentation and record keeping, energy hazards, and emergency preparedness. Each team, with their specialists in the applicable areas, assesses Engineering facilities and operations against the ES&H performance criteria identified by the LBNL Self-Assessment Program.

The Division communicates ES&H information regularly in group and division-wide meetings. The quarterly Engineering newsletter has safety as a standing article item. An ES&H web page is part of the Engineering Division web site.

C. MESH Appraisal Process

The MESH team follows the appraisal protocol described in the SRC website (url: <http://www.lbl.gov/ehs/src/html/mesh.htm>). The three primary MESH activities include an analysis of the ES&H documentation provided by the Engineering Division and the EH&S Division, an opening meeting between the MESH team and Division management, which includes the Division Director, and a field inspection of select Engineering operations. The MESH team consists of Donald Lucas, team leader from the Environmental Energy Technologies Division; Scott Taylor, Life Sciences Division; Ronald Madaras, Physics Division; and Otis Wong, Office of Assessment and Assurance.

The review of Engineering Division's ES&H documentation focused on the Division's system for work planning, hazard identification and risk analysis, establishing safety controls, evaluation of work performance, and feedback and improvement. Prior to the MESH appraisal, the Division provided responses to the MESH questionnaire and supplied supporting documentation. The EH&S Division also prepared a profile of the Division's past ES&H performance. Documents reviewed included Engineering's organization chart; ISM Plan; minutes of the ES&H Committee; injury and accident statistics; FY00 Self-Assessment Report; and the previous MESH report (1995). Supplemental information was also provided to address updated injury and accident cases, hazard identification and control, corrective actions, and inspection reports.

The MESH team conducted its review on June 1, 2001. Jim Triplett, Engineering Division Director, presented an overview of the Division's ES&H organization and program. As requested by the MESH team, several Engineering managers presented the safety programs for their department or project. Presentations were made by Richard Jared, Electronics Engineering Department Head, Ron Yourd, SNS Project Manager, and Weyland Wong, Applied Technology Department Head and Division Safety Coordinator.

Following the opening meeting, the MESH team inspected and met with the manager and/or staff in the following Engineering facilities:

- B25 Photo Fabrication Shop (point of contact: Rudy Bartolo)
- B77 Ultra High Vacuum Facility (point of contact: Al Harcourt)
- B77A Assembly Shop (point of contact: Bill Gath)

The objective of the walk-through was to give the team the opportunity to observe the type of work being performed, the hazards present in the facilities, and the administrative and engineering controls in place to mitigate any hazards. The noteworthy practices, observations and Findings resulting from the site visit are part of the MESH report.

D. MESH Appraisal Results

One of the objectives of the MESH appraisal is to provide a concise evaluation of the management of the ES&H program at the Engineering Division. In this report, the evaluation of ES&H systems, policies and procedures are broken down into noteworthy practices, observations, and findings. Noteworthy practices are procedures and systems that are recognized for their excellence and should be considered for lab-wide application. Observations indicate areas for improvement without being in violation of current regulations. Findings are either violations of applicable policies and regulations, or unsatisfactory trends or practices that if not corrected will result in violations.

1. Work Planning

The Engineering Division has a mature safety organization to integrate ES&H into its operations and projects. The Division Director chairs the Division Safety Committee. There is normally a full-time Safety Coordinator who has active support from an assistant and from the EH&S Division Liaison (the current Safety Coordinator was recently appointed, and at the present time is not yet full-time). This safety management group has the responsibility of ensuring that the Division's ESH policies and procedures are followed in the planning of work by Engineering managers and supervisors. Key issues that are addressed in the planning stage are hazard review, hazard control, safety training for employees, hazard and safety communication, and resource allocation. The Division has systems and processes to address each of these issues.

Noteworthy Practice: The Division has demonstrated a strong commitment of communicating safety to its personnel. Safety is a standing item in the Division Director's senior management meetings; there are quarterly lessons learned summaries and ES&H information in the Division newsletters; and there is broad-based involvement of Engineering personnel in the Division's self-assessment activities.

Noteworthy Practice: The staff at the Ultra High Vacuum Facility (B77) meets daily to discuss construction safety issues and other safety concerns. Such a proactive approach accentuates safety and environmental awareness among the staff, which has no recordable injuries and accidents and no regulatory violations for the past several years. The operation appears to be well organized, cleanly operated, and staffed with proficient personnel.

Observation: Safety concerns of staff appear to follow a single communication path through one's supervisor. Many of the Engineering staff interviewed are not aware of who is their representative on the Division Safety Committee nor could they name their Division Director. This may be symptomatic of the lack of two-way communication on Division-wide ES&H issues. There may be a need for other communication paths, such as the safety committee representative meeting with staff or a town-hall type meeting, to foster a comfortable dialogue between management and staff.

Finding: There is no clear understanding or guidance by the Engineering management for the responsibility of safety for its matrixed employees. This problem is due in large part to the lack of formal policy and guidance by the Laboratory (i.e., the institution). With the large number of Engineering personnel and even whole organizational structures matrixed to a host division, the responsibility and reporting lines in handling safety issues must be clear to all involved. There is no formal communication or memorandum of understanding to assure that all parties (including Engineering Division, host division, matrixed supervisor and staff, host staff, etc.) know their safety roles and responsibilities. There is also minimal oversight from the Engineering Division to assure that safety for their matrixed employees are adequately addressed. The end result is that the safety and health of some matrixed employees may be falling through the cracks. A case in point is that the Engineering personnel in Building 77A who are assembling components for the DARHT are under the assumption that the host division (i.e., AFRD) has the primary responsibility for their safety. However, the AFRD ISM Plan states the opposite, that the home division (i.e., Engineering) has the primary responsibility for its own matrixed employees. The conflicting opinions between AFRD and Engineering illustrate the need for a consistent institutional policy and protocol for matrixed employees.

2. Hazard Identification and Risk Analysis

For its operations and projects, Engineering relies on its line managers to conduct the reviews for hazards identification and risk analysis. Many of the reviews are done solely within the project or operations group, with the group leader or manager assuming the lead role for the review. If the reviews identify higher level safety concerns, the line manager would solicit the participation of outside subject matter experts. Typically, these higher level reviews involve Activity Hazard Documents (AHDs) or if radiological materials are used, Radiation Work Authorizations (RWAs) or Radiological Work Project (RWPs). For matrixed employees working on projects that have AHDs, the host division's AHDs address the safety requirements for those employees. The Division currently has eight active AHDs and no RWAs or RWPs. Hazard reviews that do not require formal authorization are documented through the Division's Project/Facility Safety Review Questionnaire.

Observation: Considering the amount and types of hazardous chemicals and equipment in the facilities visited, there is a lack of signage in some areas cautioning and instructing personnel on the particular hazards. Some of the signage that is present is confusing and/or potentially ineffective because there is too much information (i.e., too many signs posted in one area). The inconsistent signage was particularly pronounced in the Photo Fabrication Shop (B25).

Observation: During the visit to the B77A Assembly Shop, Engineering personnel were building and testing components for the DARHT project. Identifying and resolving safety issues are done under the auspices of the DARHT AHD that is managed by the Accelerator Fusion Research Division. A review of the DARHT AHD did not identify the work being performed or the safety requirements for the involved employees in the B77A Assembly Shop. The MESH team acknowledges that other reviews, such as the electrical safety review and the Pulse Forming Network (PSN) procedure review, were conducted. However, the AHD process is intended to be the all-encompassing safety review for projects with significant hazards.

Finding: Hazard review of projects, in particular projects that do not require formal authorizations (i.e., projects with lower hazards), are not being done systematically and with appropriate oversight. The Project/Facility Safety Review Questionnaire that was intended to screen all projects for hazards is not being widely used. The Division's policy is that the line manager is responsible for the safety review of all potentially hazardous activities. However, there is little documentation that such reviews are occurring regularly and with appropriate rigor. The lack of oversight by the Division safety management group and/or EH&S subject matter experts also perpetuates the uncertainty of the hazard reviews. A case in point is the construction and testing of the UV equipment in Building 25, where there was no obvious safety review conducted by either the line, EH&S, or the Division Safety Coordinator. Although the equipment may in fact be relatively safe, a documented review process needs to be in-place to validate such facts.

Finding: Review of the Division's Activity Hazard Documents (AHD) is informal and/or incomplete. The AHD for the Photo Fabrication Shop (B25) was incomplete with pages missing and appeared to be an older version (1994) that does not follow the current AHD guidelines for content. The AHD for the Ultra High Vacuum Facility did not have the current listing of authorized personnel nor did it have the sign-offs to document the annual reviews. Because the documentation is missing or incomplete, it is unclear whether the AHD reviews of the higher hazard operations are being done on an annual basis and with appropriate rigor.

3. Establishment of Controls

The Division has a significant number of formal authorizations (AHDs, Sealed Source Authorizations, wastewater discharge permits, WAAs, and SAAs) where hazard controls are well identified and established. For other operations and projects, the line manager assumes the primary responsibility for establishing the appropriate engineering and administrative controls. The Division also emphasizes completion of required ES&H training and the active communication of ES&H policies and procedures to staff. The Division's self-assessment performance results indicate that the controls are in place and effective in mitigating the hazards associated with Engineering work activities.

Noteworthy Practice: Engineering has consistently had a high completion rate for completing the Job Hazard Questionnaire (JHQ) and required ES&H training, including emergency response training for its building emergency teams. Their current JHQ completion rate is at 98%, and completion of required training is at 95%. Many Engineering personnel have also completed

their recommended training. Of particular note is the staff at B77 and B25 where they have completed additional training to address their high hazard work with chemicals. For example, each of the staff in B77 has completed the highly recommended HAZWOPER training.

Observation: Engineering managers and supervisors do not normally document on-the-job training that mitigates safety concerns. The MESH team recognizes that the documentation of on-the-job training may not be necessary for all cases, but when the on-the-job training involves the identification of hazards and hazard control procedures, it is incumbent on the Engineering Division to demonstrate that its employees are sufficiently trained to mitigate the hazards, especially when the training is the supervisor instructing the employee on the job.

Observation: With such a large Division and with so many on-going projects, Engineering has many participating guests working at its facilities, and conversely, many of its own staff working at non-LBNL sites. Participating guests at LBNL must meet all of the safety training requirements as for regular employees. There does not appear to be an on-going process to assure adequate safety training of LBNL personnel at non-LBNL facilities.

Finding: The location of the emergency eyewash and safety shower station in B25 does not allow for easy and quick access as required by the Chemical Hygiene Plan (this deficiency was identified and communicated to the Division earlier by a DOE inspector). The cyanide treatment bath in B25 is located in a room that requires an employee to pass through two doorways and down a corridor with multiple obstructions to reach the eyewash/shower station. In addition, the area around the station is not level, but it drops down off the main floor. Employees with eye injuries would have a difficult time reaching the station within the required 10 seconds.

4. Work Performance

In general, the Division consistently performs work in a safe manner and within the established controls. For the past several years, Engineering has had a relatively low Total Recordable Case (TRC) and Lost Workday Case (LWC) rates. There has been only one ORPS Occurrence Report in the past three years. The one occurrence, involving the unplanned discharge of chemicals into the sanitary sewer, resulted in root cause analysis and significant changes in the operation, so the likelihood of a repeat occurrence is extremely remote. The Division has also not received any regulatory violations or non-compliance notices for any of its authorized or permitted work. Engineering's waste management is at a 98% compliance rate for SAAs and WAAs.

Noteworthy Practice: For the past two years, the Engineering Division has scored exceptionally high in its ES&H self-assessment performance rating. The Division garnered successive scores of 98% and 97% ratings for FY99 and FY00 respectively. The ratings, along with other performance metrics, indicate that the Division is operating at a very safe level and that the Division has an active ES&H program.

Observation: The Photo Fabrication Shop is usually staffed with one person. Given the various types of hazards present in the facility, there is a concern that in the event of an accident or

emergency, the one individual may be in jeopardy. An emergency support system, such as a signaling device, call schedule, or a second person while performing hazardous work, should be considered.

Observation: If a safety issue related to the work on a project is discovered, the project leader or supervisor will resolve the issue internally, with no oversight by the Division Safety Management group unless requested by the leader or supervisor. The mitigation of the safety issue is also usually done internally and with limited documentation. The Division should develop an oversight process to review modified projects or to address newly discovered project safety issues.

5. Feedback and Improvement

The Division has established numerous vehicles to promote feedback and improvement. The Safety Management Group has established regular communication to its personnel through newsletters, websites, and regular interaction with Division management. Through its active self-assessment program, the Division regularly evaluates its workspace and operations to identify unsafe conditions. Corrective actions for safety deficiencies are tracked by the Division's LSAD system.

Noteworthy Practice: The Division Director is very much involved in the day-to-day operations of the safety program. He is the chair of the Division Safety Committee and works closely with the Safety Coordinator and the EH&S Division Liaison. The Director is also extremely active in conducting safety walkthroughs of his Engineering facilities. By his estimate, he has done 20-30 walkthroughs this past year.

Noteworthy Practice: The set-up of the self-assessment teams is noteworthy for involving a broad spectrum of Engineering personnel and providing them with training and resources in particular areas of ES&H. The teams have demonstrated their proficiencies in past years and provide the Division with an active self-assessment program. It is noted that currently there are many vacancies on the teams, and it is imperative that the Division fills these vacancies to sustain the past effort.

Observation: As discovered by the Division's self-assessment teams, many of the LSAD deficiencies are related to violations of chemical hygiene and waste management rules. There is a concern that the chemical users and waste generators are either not aware, trained, or held accountable of their responsibility.

Observation: Some LSAD deficiencies were given low hazard ratings. For example, blocked fire extinguishers and storage of hazardous chemicals without secondary containment should be considered as Hazard Level 2 deficiencies instead of Hazard Level 3, or at the minimum, should be given a higher priority for correction.

Observation: Corrective actions in the Division's LSAD database are not being closed out in a timely manner. All LSAD deficiencies reviewed by the MESH team, including deficiencies

discovered more than six months ago, have not been tracked for completion on the LSAD database, even when the safety corrections are made. Proper documentation of correcting safety deficiencies in a timely manner is part of the UC/DOE ES&H contract.